

Attorney's Docket: 200205313  
Serial No.: 10766390  
Group: 1621  
Response to Final Rejection Mailed 02/25/2005

#### REMARKS

The Office Action mailed March 25, 2004, has been carefully considered together with each of the references cited therein. The remarks presented herein are believed to be fully responsive to the Office Action. Accordingly, reconsideration of the present Application in view of the following remarks is respectfully requested.

#### CLAIM STATUS

Claims 1-15 are pending in this Application, and by this Amendment.

#### Telephonic Interview

Applicant would like to thank the examiner for the opportunity to discuss the merits of the instant case in a telephonic interview with applicant's representative, Mr. Richard Silverman, on 17 March 2005. In the interview, Mr. Silverman pointed out that the instant invention was directed to chlorination of dialkylbenzenes, not mono-alkylbenzenes, and that both US Patents 4,647,709, and 4,289,916 cited by the examiner disclosed only mono-alkylbenzenes, and that it is well established in the chemical arts that there is an inherent mystery surrounding the unpredictability of the performance of catalysts in the chemical arts. Thus, no one skilled in the art could assume with any certainty what effect adding a second alkyl group to the core benzene ring would have on the o-p ratio of the chlorinated product of in the process of either reference, wherein both a catalyst and a co-catalyst are employed. The only conclusion might be that it might be "obvious-to-try", but "obvious-to-try" is not the standard of 35 USC 103. No agreement was reached in connection with any of the pending claims.

#### Claim Rejection Under 35 USC § 103

Claims 1-15 stand finally rejected under 35 USC §103(a) as being unpatentable over Wolfram (US 4,647,709) in view of Nakayama et al. (US 4,289,916). The rejection of claim 1 under 35 USC §103(a) as being unpatentable over Wolfram (US 4,647,709) in view of Nakayama et al. (US 4,289,916) should be withdrawn for the reason that both the '709 and the '916 patents only disclose methods for nuclear chlorination of mono-straight chain and mono-branched chain alkylbenzenes, such as toluene, ethylbenzene, and isopropylbenzene, not dialkylbenzenes, such as xylenes, and that

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obvious-to-try is not the same as obviousness, particularly in view of the unpredictability of the performance of catalysts in the chemical arts.

Applicants' invention is directed to a method for the nuclear chlorination of a dialkylbenzene, ortho-xylene which includes reacting ortho-xylene with a chlorinating agent in the presence of at least one Friedel-Crafts catalyst and chlorine-substituted 2,8-dimethylphenoxathin as a co-catalyst. Importantly, the ratio of 4-chloro to 3-chloro-1,2-dimethylbenzene is at least 3 to 1. Applicants have surprisingly and unexpectedly discovered that the present invention provides a substantial improvement in the yield of 4-chloro-1,2-dimethylbenzene.

Nakayama et al. discloses a process for selectively producing p-chloroalkylbenzene by chlorinating a mono-straight chain alkylbenzene, a mono-branched chain alkylbenzene, preferably where the alkylbenzene has a C<sub>1</sub> to C<sub>4</sub> alkyl group (See column 3, lines 4-7). In the presence of phenothine and a Lewis acid or its precursor as a catalyst. The Nakayama reference exemplifies ethylbenzene, cumene(isopropylbenzene), and toluene. The ratios of o-p- for toluene reported by the Nakayama reference ranged from 0.68 to 0.92 unless the alkyl group was also chlorinated. The resulting chlorinated product o-p- ratio for ring chlorination of ethylbenzene and cumene, representing larger alkyl substituents, was lower than toluene or monoalkylbenzenes with chlorinated side chains.

Wolfram teaches a process for ring-chlorinating toluene and specifically states in the abstract that "a particularly high proportion of p-chlorotoluene is obtained by in addition to the customary Lewis acid catalysts as co-catalyst a chlorination product of 2,8-dimethyl-phenoxathin."

The Office is of the position that the only difference between the instant claims and the invention of Wolfram is that Wolfram chlorinates toluene, whereas Applicant chlorinates xylene. The Office further states that the chlorination of xylene is similar to the chlorination of toluene in the presence of a phenoxathine compound. The office concludes, one having ordinary skill in the art at the time the invention was made would reasonably believe that based on the teachings of Nakayama et al. that the substitution of xylene for toluene in the process of Wolfram would result in an increase in the p-to-ratio. Applicants respectfully disagree. Nowhere in Nakayama is it disclosed

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that a dialkylbenzene, such as xylene, can be substituted for a mono-straight chain alkylbenzene or a mono-branched chain alkylbenzene. It is interesting to note that Nakayama was only able to obtain a ratio of o-/p- of up to 1.7 in chlorinated toluene, only after a large amount of the side-chain chlorinated toluene product was detected (See Nakayama, Example Reference 2, Column 6, lines 45-60). The disclosure of Wolfram is limited to ring-chlorination of toluene with the objective to increase the proportion of p-chlorotoluene. The Wolfram method employing both a Lewis acid catalyst and a co-catalyst produces a p-/o- ratio above 1.6 (See column 4, line 25), but all of the examples further clarify this statement to mean an o-/p- ratio ranging between 1.66 and 1.67 (See Examples 1 and 2 bridging column 6 and 7). There is no example of any o-/p- ratio in any of the ring-chlorination processes of either reference which is greater than about 1.7.

Clearly, anyone skilled in the art having both the Nakayama reference and the Wolfram references would only be able to conclude that ring chlorination of xylenes, a dialkylbenzene in the presence of a Lewis acid and a co-catalyst would be obvious-to-try, and that, with respect to monoalkylbenzenes, when the alkyl chain was increased from a single carbon atom (toluene) to 2 or 3 carbon atoms (ethyl or propylbenzene), the ratio of o-/p- in the product was reduced. There is no teaching in either reference which suggests how the ratio of o-/p- will vary if a second alkyl group is attached to the monoalkylbenzenes.

Catalyst activity is unpredictable, and modest changes in catalyst composition can have a profound and unpredictable effects on the results obtained. This recognition of unpredictable catalyst behavior is well accepted in the catalyst art. Catalytic systems involve a high order of unpredictability. Since the manner in which catalysts operate is not fully understood, it is almost impossible to predict whether a given material will function as a catalyst without trial. Any rejection on this ground cannot be sustained. Even a minor change may produce a patentable invention where the result could not have been predicted beforehand by one skilled in the art.

One of the more difficult aspects of resolving questions of non-obviousness is the necessity to guard against slipping into use of hindsight. Many inventions may seem obvious to everyone after they have been made.

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However 35 USC 103 instructs us to inquire whether the claimed invention would have been obvious at the time of the invention was made to a person having ordinary skill in the art to which the subject matter pertains. In light of Applicant's evidence, the argument that a chemist of ordinary skill in the art would have recognized a connection between a catalyst of the prior art and a different chemical species, being unsupported by objective evidence of record, fails to establish a prima facie case of obviousness. The office has suggested a reason why it might have been obvious to try using the catalyst of Wolfgram with a dialkylbenzene to improve the o/p-ratio in ring chlorination, but obvious to try is not the standard of 35 USC 103.

A sustainable case of obviousness requires the prior art to provide motivation to one with ordinary skill in the art to arrive at the claimed invention. Here such motivation is absent. Furthermore, the prior art does not present to the ordinary artisan a reasonable expectation of success that the modification advanced by the Office would yield a 3:1 ratio of 4-chloro- to 3-chloro-1,2-dimethylbenzene.

As further support that one skilled in the art could not predict the performance of a catalytic ring chlorination of a dialkylbenzene species, Applicant herein repeats the following argument earlier presented in the paper filed on 25 August 2004. The chlorination of toluene in the presence of  $\text{FeCl}_3$  usually leads to the formulation of o-toluene, wherein the ortho:para ratio is in the range of 65%:35%. See Ullmann's Encyclopedia of Industrial Chemistry 5<sup>th</sup> edition, Vol. A8, page 343 (a copy of which was enclosed in the IDS filed 25 August 2004). The addition of the co-catalyst "chlorinated dimethylphenoxathin" leads to the activation of the p-position, so that the ortho:para-ratio is then 40%:60% (Wolfgram US 4,847,709). Recalling that the chlorination of ortho-xylene in the presence of  $\text{FeCl}_3$  yields 4-chloro-o-xylene: 3-chloro-p-xylene in a ratio of 60%:40% (US 4,180,608), No one having ordinary skill in the art, armed with a knowledge of Wolfgram and Nakayama would be motivated to alter the Wolfgram reference as suggested by the Office in order to derive a method to maximize the ratio of 4-chloro- to 3-chloro-1,2-dimethylbenzene. The suggested teachings of the references, combined with that which is known by the artisan of ordinary skill, would lead to the expectation by one with ordinary skill in the art that the addition of the same

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co-catalyst, i.e., the dimethylphenoxathin, the less favored substitution position would be activated and therefore favor the formation of the 3-chloro-o-xylene. Consequently, one with ordinary skill in the art, having a knowledge of these references would derive no motivation there from to alter the process taught by Wolfram by substituting xylene for toluene as the references do not provide any teaching which suggests that this combination of co-catalyst and dimethylphenoxathin advantageously leads to the formation of 4-chloro-1,2-dimethylbenzene.

The Office's position of obviousness is also wanting as the mandated reasonable expectation of success is lacking in the proposed modification of the prior art. One with ordinary skill in the art, having a knowledge of Wolfram and Nakayama, would not enjoy any reasonable expectation of success that the claimed method with the substitution of a dialkylbenzene for the monoalkylbenzene maximizes the yield of 4-chloro-1,2-dimethylbenzene rather than the 3-chloro 1,2-dimethylbenzene. Specifically, the prior art suggests that directly the opposite will transpire, namely the favoring of the 3-chloro-1,2-dimethylbenzene to the disadvantage of the 4-chloro isomer. In fact, the combined teaching of the references, and that which is known by one with ordinary skill in the art, teach away from the instant invention, as all indications of the prior art suggest that the 3-chloro-1,2-dimethylbenzene would be formed to the detriment of 4-chloro-1,2-dimethylbenzene.


As neither Wolfram nor Nakayama can provide one with ordinary skill in the art with the motivation necessary to achieve the present invention, it is courteously suggested that the Office is employing impermissible hindsight gained by a knowledge of Applicants' invention. Furthermore, the expectation of success, which is nowhere present in the prior art, is also seen to exist only in Applicants' disclosure. In consequence, Applicants contend that claim 1 as amended is not made obvious by any combination of Wolfram and Nakayama and courteously request reconsideration and withdrawal of the § 103 rejection. The rejection of claims 2-15 as amended, under 35 USC §103(a) as being unpatentable over Wolfram (US 4,647,708) in view of Nakayama et al. (US 4,289,916) should be withdrawn for the reasons given in support of claim 1 from which they depend.

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As the total number of claims does not exceed the number of claims originally paid for, no fee is believed due. However if an additional fee is required, the Commissioner is hereby authorized to credit any overpayment or charge any fee deficiency to Deposit Account No. 03-206D.

In view of the foregoing remarks, the present application is believed to be in condition for allowance, and reconsideration of it is requested. If the Examiner disagrees, she is requested to contact the attorney for Applicants at the telephone number provided below.

Respectfully submitted,



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